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ABSTRACT

Part of the Delaware Department of Education's ongoing efforts to provide assistance and support to local school districts in their development of a standards-based curriculum, this document presents the eight science standards for middle school. The standards for grades 6-8 are: (1) nature and application of science and technology; (2) materials and their properties; (3) energy and its effects; (4) Earth in space; (5) Earth's dynamic systems; (6) life processes; (7) diversity and continuity of living things; and (8) ecology. (YDS)

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TOPICAL PATHWAYS
6–8 Science

6	Science as Inquiry: Understanding the Context and Processes of Science	Investigating the Rock Cycle as Evidence of a Changing Earth	Building an Understanding of Forces That Cause Motion	Developing Criteria for Classifying Living and Nonliving Things
7	Using Physical and Chemical Properties to Distinguish and Separate Mixtures and Solutions	Investigating the Cellular Dimensions of Living Systems	Genetics: The Key to Inheritance and Diversity	Understanding the Importance of Protecting Delaware Watersheds
8	Investigating How Energy Transformations Drive Physical, Chemical, and Biological Processes	Explaining How the Sun's Energy Drives Earth's Weather and Climate	Constructing Models That Explain the Visual and Physical Relationships Among the Earth, Sun, Moon, and the Solar System	Tracking Growth, Change, and Adaptations in Ecosystems Over Time

SCIENCE STANDARD ONE

Nature and Application of Science and Technology

END OF CLUSTER EXPECTATIONS

By the end of grade 8 students will know that:

Science as Inquiry

the design of an investigation, in many cases, is determined by the type of questions asked. Therefore, the thoughtful and informed structuring of such questions is an important part of scientific inquiry. For example, a questions such as, "what are the similarities and differences among the plants that grow in this region?" requires a taxonomic investigation in which plants are collected, identified, and classified. On the other hand, answering "What was the reaction of Marie Curie's contemporaries to her work and accomplishment?" may involve consulting, reviewing, and discussing both contemporary and historical publications as part of an investigative design. However, an experimental investigation in which systematic observations are made and in which data are used and analyzed to construct an explanation could result from a question such as, "How do the physical properties of local soil samples lead to differences in drainage or percolation?"

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Science, Technology, and Society

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PERFORMANCE INDICATORS

Nature and Application of Science and Technology

Grade Six

Topic: Science as Inquiry: Understanding the Context and Processes of Science

Students will be able to:

6.301 identify reasonable, relevant, and testable questions that can be answered through scientific investigations.

6.302 design and conduct simple scientific investigations.

6.303 compare and contrast observations of the same object or phenomena and discuss why differences in observations exist.

6.304 select and use appropriate tools, technology, and mathematical techniques to gather, analyze and interpret data.

6.305 develop descriptions, explanations, predictions, and models based on evidence.

6.306 form logical explanations about the cause and effect relationship in an investigation.

Grade Seven

Topic: Science as Inquiry: Understanding the Context and Processes of Science

Students will be able to:

7.349 identify reasonable, relevant, and testable questions that can be answered through scientific investigations.

7.350 design and conduct simple scientific investigations.

7.351 compare and contrast observations of the same object or phenomena and discuss why differences in observations exist.

7.352 select and use appropriate tools, technology, and mathematical techniques to gather, analyze and interpret data.

7.353 develop descriptions, explanations, predictions, and models based on evidence.

7.354 form logical explanations about the cause and effect relationship in an investigation.

Grade Eight

Topic: Science as Inquiry: Understanding the Context and Processes of Science

Students will be able to:

8.350 identify reasonable, relevant, and testable questions that can be answered through scientific investigations.

8.351 design and conduct simple scientific investigations.

8.352 compare and contrast observations of the same object or phenomena and discuss why differences in observations exist.

8.353 select and use appropriate tools, technology, and mathematical techniques to gather, analyze and interpret data.

8.354 develop descriptions, explanations, predictions, and models based on evidence

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PERFORMANCE INDICATORS

Nature and Application of Science and Technology

Grade Six

Topic: Science as Inquiry: Understanding the Context and Processes of Science (continued)

Students will be able to:

6.307 present and defend experimental results by describing observations and methods, summarizing data, and generating reasonable explanations.

6.308 evaluate and provide appropriate feedback regarding experimental results and explanations proposed by other students.

6.309 explain what makes science different from other disciplines (e.g., science is the study of nature; science has established rules for acquiring evidence; science verifies claims, assertions, and theories). Describe what science tells us that other disciplines do not.

6.310 cite examples of important contributions made in science and technology by diverse cultures over time.

6.311 identify barriers women and minorities have experienced in their attempts to become scientists.

6.312 research contributions and discoveries made by Delaware scientists and describe their impact.

Grade Seven

Topic: Science as Inquiry: Understanding the Context and Processes of Science (continued)

Students will be able to:

7.355 present and defend experimental results by describing observations and methods, summarizing data, and generating reasonable explanations.

7.356 evaluate and provide appropriate feedback regarding experimental results and explanations proposed by other students.

7.357 explain what makes science different from other disciplines (e.g., science is the study of nature; science has established rules for acquiring evidence; science verifies claims, assertions, and theories). Describe what science tells us that other disciplines do not.

7.358 cite examples of important contributions made in science and technology by diverse cultures over time.

7.359 identify barriers women and minorities have experienced in their attempts to become scientists.

7.360 research contributions and discoveries made by Delaware scientists and describe their impact.

Grade Eight

Topic: Science as Inquiry: Understanding the Context and Processes of Science (continued)

Students will be able to:

8.356 present and defend experimental results by describing observations and methods, summarizing data, and generating reasonable explanations.

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PERFORMANCE INDICATORS

Nature and Application of Science and Technology

Grade Six

Topic: Investigating the Rock Cycle as Evidence of a Changing Earth

Students will be able to:

6.313 identify and classify rocks and minerals according to their physical and chemical properties.

6.315 create models of rock formation to investigate how igneous, sedimentary, and metamorphic rocks are formed.

6.316 classify unknown rock samples (e.g., igneous, sedimentary, or metamorphic) based on identifiable characteristics. Explain how this method of classifying is related to the rocks' formation.

6.317 investigate factors that cause weathering of rocks (e.g., exposure to wind, precipitation, temperature changes, plant growth, acid rain, etc.).

6.318 survey the local area (e.g., walk around the school building, visit a cemetery) to observe, describe, and explain visual and structural effects of weathering on both natural and manmade rock structures.

Grade Seven

Topic: Using Physical and Chemical Properties to Distinguish and Separate Mixtures and Solutions

Students will be able to:

7.302 observe, measure, and compare characteristic properties of a variety of substances.

7.304 identify common materials found in the classroom or at home which are mixtures or solutions and conduct investigations to determine the components of those mixtures or solutions (e.g., chromatography, reading labels).

7.305 conduct investigations to identify factors that affect the rate of solubility.

7.306 use ratios and percentages to prepare solutions of different concentrations.

7.308 investigate and discuss why the measurements of specific components of a physical mixture are reported to people (e.g., particles in the air, cholesterol in blood, unsaturated fats in foods, turbidity in lakes) and how the measurements are used to monitor health problems and or environmental pollutants.

Grade Eight

Topic: Investigating How Energy Transformations Drive Physical, Chemical, and Biological Processes

Students will be able to:

8.304 conduct simple investigations with a variety of materials (sand, water, cloth, objects) to describe and measure the effects (including both physical and chemical changes) of light energy on these materials.

8.306 conduct simple investigations to demonstrate that heat flows from one object to another in predictable ways, from warmer objects to cooler ones, until both reach the same temperature.

8.308 use models to explain how variations in the amount of Sun's energy hitting the Earth's surface results in seasons.

8.309 use a variety of models, charts, diagrams, or simple investigations to explain how the Sun's energy causes water to cycle through the Earth's crust, oceans, and atmosphere.

SCIENCE STANDARD ONE

Nature and Application of Science and Technology

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Nature and Application of Science and Technology

Grade Six

Topic: Investigating the Rock Cycle as Evidence of a Changing Earth (continued)

Students will be able to:

6.319 examine soil samples to identify and discuss factors that determine soil composition and structure (type of underlying rocks, climate, sorts of vegetation present).

6.320 investigate how rocks are cycled through the processes of weathering, erosion, transport, and deposition.

6.321 conduct simulations to demonstrate how erosion (e.g., beach erosion) and soils (e.g., beach formation) lead to the development of land forms.

6.322 recognize that successive layers of sedimentary rock and the fossilized remains found in those layers confirm Earth's long history.

Grade Seven

Topic: Using Physical and Chemical Properties to Distinguish and Separate Mixtures and Solutions (continued)

Students will be able to:

7.309 develop investigations or use models to explore how solutions spread or move from an area of higher concentration to one of lower concentrations.

7.310 investigate what types of barriers (e.g., cell membrane, soil type) would prohibit or prevent the movement of a solution from one area to another.

Topic: Investigating the Cellular Dimensions of Living Systems

Students will be able to:

7.312 observe both unicellular and multicellular organisms to identify common life processes. Recognize that the more complex the organism, the greater the extent of cellular specialization.

Grade Eight

Topic: Investigating How Energy Transformations Drive Physical, Chemical, and Biological Processes (continued)

Students will be able to:

8.311 conduct investigations to determine how the physical (e.g., size, shape, color, texture, hardness) and characteristic properties (e.g., boiling points, melting points, solubility) of materials can account for the degree of change observed in the materials when they interact with the same amount of energy (for example: dark cloth absorbs more heat than light cloth, clear water transmits more light than murky water, water retains heat longer than sand, shiny material reflects more light than dull material).

8.313 conduct simple investigations to determine how constructive and destructive forces alter the surface of the earth (e.g., build model glaciers, formation of river beds, stream tables that model weathering and erosion, model wind erosion, etc.)

Topic: Explaining How the Sun's Energy Drives Earth's Weather and Climate

Students will be able to:

8.317 record and interpret daily weather measurements over an extended period of time using a variety of instruments (e.g., barometer, anemometer, sling psychometer, etc.).

SCIENCE STANDARD ONE

Nature and Application of Science and Technology

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PERFORMANCE INDICATORS
Nature and Application of Science and Technology

Grade Six

Topic: Investigating the Rock Cycle as Evidence of a Changing Earth (continued)

Students will be able to:

6.323 compare and contrast fossils and anatomical models to draw reasonable conclusions regarding evolutionary change over time (e.g., trilobites → horseshoe crabs, belemnites → squid).

Topic Building an Understanding of Forces that Cause Motion

Students will be able to:

6.324 conduct investigations to demonstrate that a force causes a resting object to move, brings a moving object to rest, or changes the direction of a moving object.

6.326 observe and compare the speed of objects when forces such as friction are varied.

6.328 use simple machine principles to design a device which performs a task (e.g., lift a weight, move a heavy object). Explain the forces and motions involved.

6.329 conduct investigations to determine how invisible forces such as magnetism and static electricity can cause objects to move.

6.332 design simple investigations to determine the effect different variables (number of turns of wire around the core, the material that the core is made of, diameter of the core) have on electromagnetic strength.

Grade Seven

Topic: Investigating the Cellular Dimensions of Living Systems (continued)

Students will be able to:

7.315 use microscopes and other appropriate tools and technology to observe and compare a variety of unicellular organisms. Explain how specific cellular structures perform such specialized functions as water regulation, digestion, locomotion, and circulation.

7.316 use microscopes and other appropriate tools and technology to observe multicellular organisms (plant and animal cells) and explain how the structures of the major organelles are related to the functions they perform.

7.320 conduct simple investigations (how the body reacts to exercise, changes in temperature, etc.) to determine how the systems in the human organism respond to various external stimuli to maintain stable internal conditions.

7.322 research the sequence of events that lead to formulation of the cell theory and explain how the events correlate with technological advancements.

Grade Eight

Topic: Explaining How the Sun's Energy Drives Earth's Weather and Climate (continued)

Students will be able to:

8.319 use weather maps to describe the movement of air masses, fronts, and storms and to predict their influence on local weather.

8.325 examine satellite imagery pictures and describe the use of these images in photographing weather systems and producing forecasts.

Topic: Constructing Models that Explain the Visual and Physical Relationships Among the Earth, Sun, Moon, and the Solar System

Students will be able to:

8.328 use models, charts, illustrations, and other suitable representations to predict regular patterns of motion for most objects in the solar system.

8.331 construct scale models of the solar system in order to describe the relative sizes of planets (as viewed from Earth) and their distances from the Sun. Understand how a telescope magnifies the appearance of certain objects in the sky, including the Moon and the planets.

8.334 observe and demonstrate that patterns of stars only appear to move across the sky and that different stars can be seen at different times of the year.

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PERFORMANCE INDICATORS

Nature and Application of Science and Technology

Grade Six

Topic: Developing Criteria for Classifying Living and Nonliving Things

Students will be able to:

6.338 examine an assortment of plants and animals and use simple classification keys, based on observable features, to sort and group the organisms.

6.339 investigate appropriate methods that could be used to obtain samples of plants and animals from a specific area. Design and conduct a survey of the area to explain the diversity of local plants and animals.

6.340 discuss how the different species of plants and animals, from the area surveyed, might be classified. Develop classification flow charts (dichotomous keys) to group and classify the observed species.

6.343 conduct investigations to determine the difference between melting and dissolving (characteristic properties). Recognize that melting requires only one substance while dissolving requires two substances.

6.344 conduct investigations to determine that different pure substances melt or boil at different temperatures and that these differences can be used to classify or sort objects, materials, or substances.

Grade Seven

Topic: Genetics: The Key to Inheritance and Diversity

Students will be able to:

7.325 use models or diagrams to explain why sexually produced offspring are never identical to their parents.

7.326 use models or diagrams to identify the structures of a flowering plant that produce eggs and sperm and explain that plants also reproduce sexually.

7.328 use models to demonstrate that chromosomes and genes come in pairs and that chromosomes are composed of many genes. Use these same models to discuss how genetic material is transmitted from cell to cell or from parent to offspring.

7.330 use a variety of resources to develop a report on selective breeding. Select an organism (e.g., super sweet corn, oven stuffed roaster) and trace its history of development and the traits of the plant or animal that were enhanced by selective breeding.

7.333 observe a variety of organisms and explain how a specific trait could increase an organism's chances of survival.

7.334 conduct a natural selection simulation to demonstrate that a specific trait has selective advantages for an organism.

Grade Eight

Topic: Constructing Models that Explain the Visual and Physical Relationships Among the Earth, Sun, Moon and the Solar System (continued)

Students will be able to:

8.335 investigate how some people have used the movement of objects in the sky in order to tell time and location.

Topic: Tracking Growth, Change, and Adaptations in Ecosystems Over Time

Students will be able to:

8.342 construct data tables or line graphs to show population changes of a selected species over time.

8.343 observe graphs or data tables showing both the population growth of a species and the consequences of resource depletion on the population. Analyze the data and explain how exponential growth can have a dramatic effect on resources.

8.345 investigate and discuss how short-term physiological adaptations of an organism (e.g., skin tanning, muscle development, formation of calluses) differ from long-term evolutionary adaptations (e.g., white coloration of polar bears, seed formation in plants) that occur in a group of organisms over generations.

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Science as Inquiry

the design of an investigation, in many cases, is determined by the type of questions asked. Therefore, the thoughtful and informed structuring of such questions is an important part of scientific inquiry. For example, a questions such as, "what are the similarities and differences among the plants that grow in this region?" requires a taxonomic investigation in which plants are collected, identified, and classified. On the other hand, answering "What was the reaction of Marie Curie's contemporaries to her work and accomplishment?" may involve consulting, reviewing, and discussing both contemporary and historical publications as part of an investigative design. However, an experimental investigation in which systematic observations are made and in which data are used and analyzed to construct an explanation could result from a question such as, "How do the physical properties of local soil samples lead to differences in drainage or percolation?"

the ultimate goal of any scientific investigation is to obtain evidence precise and thorough enough to answer a question. Various experimental designs and strategies can be developed to answer the same question. The comprehensiveness and sophistication of the investigation depend on the tools and technologies used.

explanations in science result from careful and logical analysis of evidence gained from an investigation. Explanations relate causes to effects and develop relationships based on evidence. Critical analysis skills learned in the classroom can be applied to judge the validity of claims made in everyday life.

Science, Technology, and Society

social, cultural, environmental, scientific and technological strengths, and economic facts influence which scientific and technological areas are pursued and invested in. At the same time, the scientific discoveries made and technologies developed directly influence society and its habits, organization, and cultural values.

the issues surrounding science, technology, and society are complex and involve many risk/benefit considerations. Even though new technology may provide a solution to an important problem, its impact on human health, the environment, and social dynamics needs to be analyzed.

History and Context of Science

over the course of human history, science has been practiced by different people in different cultures. Unfortunately, women and minorities have often been discouraged or denied the opportunity of participating in science because of education and employment prejudices or restrictions.

people engaged in doing science are found in many occupations and institutions such as hospitals, universities, classrooms, industry, and farms. The nature of scientific investigation often requires that teams of individuals with different abilities work together to solve a problem or to understand the natural world.

The areas listed above will serve as the basis for Science assessment items in the Delaware Student Testing Program.

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PERFORMANCE INDICATORS

Nature and Application of Science and Technology

Grade Six	Grade Seven	Grade Eight
	Topic: Understanding the Importance of Protecting Delaware Watersheds **Students will be able to:** 7.337 use models or diagrams to explain how water stored underground and water stored above ground form a continuum each supply water to the other. 7.341 conduct tests (e.g., pH, dissolved oxygen) or surveys (e.g., macroinvertebrate) to determine the ecological health and potability of local water samples. 7.342 conduct investigations to determine the extent to which the permeability and porosity of a soil sample affect water percolation. 7.346 research the processes used by municipalities to ensure water taken from local reservoirs is safe to drink. 7.347 investigate the extent to which legislation such as the Clean Water Act has impacted the quality of Delaware water.	**Topic: Tracking, Growth Change and Adaptations in Ecosystems Over Time (continued)** **Students will be able to:** 8.346 investigate local areas, disturbed and undisturbed, that are undergoing natural cycles of succession such as, abandoned gardens; uncut areas beneath power lines; areas along ditch banks, fences, and the edge of a forest. Predict how plant communities that grow in the area may change over time and how their presence determines what kinds of animals may move into and out of the areas. 8.347 research and analyze data on human population changes that have occurred in a specific Delaware area or county. Discuss reasons for changes in human population and explain how these changes have affected biodiversity and availability of natural resources (e.g., habitat loss, water quality, preservation/concentration efforts). 8.348 investigate some of the economic and environmental tradeoffs given Delaware's short-term and long-term resource management plans. 8.349 contact the Department of Natural Resources or a wildlife agency to acquire information on animals or plants that have been introduced to Delaware. Investigate issues that relate to the introduction or reintroduction of a species into a local habitat (e.g., Norway Maple, Delmarva Fox Squirrel, Gypsy Moth, Phragmites)

SCIENCE STANDARD TWO

Materials and Their Properties

END OF CLUSTER EXPECTATIONS

By the end of grade 8 students will know that:

Properties and Structure of Matter

elements are substances that cannot be decomposed into simple materials by chemical reaction. However, elements can react with other elements or materials to form compounds. There are more than 100 known elements which combine in a multitude of ways to produce compounds, which account for all living and nonliving substances.

the three states or phases of matter (solid, liquid, gas) are determined by the arrangement, motion, and interaction of molecules. In the solid state, molecules are packed tightly together and their movement is restricted to vibrations. In the liquid state, molecules are more loosely packed and can slide past each other. In the gaseous state, molecules are less restricted and move freely. Changes in state require the addition or removal of heat but result in no change in the chemical structure of the material. Changes in the temperature, pressure, or volume of a gas result in predictable changes in the other properties.

some physical properties such as mass and volume depend upon the amount of material; others such as density and melting point, known as characteristic properties, are independent of the quantity and are unique to the material.

Mixtures and Solutions

mixtures have component parts. Most natural materials, such as milk, blood, mineral ores, sea water, soil, and air; and man-made materials, such as processed foods, cosmetics, and paints, are physical mixtures consisting of a variety of components in a wide range of concentrations. The individual components can be analyzed and separated by making use of their unique chemical and physical properties.

solutions are homogenous mixtures of two or more components. The properties of a solution depend on the nature and concentration of the solute(s) (the material being dissolved) and the nature of solvent(s) (the medium in which the solutes are dissolved).

Transformation and Conservation of Matter

substances react chemically in characteristic ways with other substances to form new substances. In all chemical reactions the total mass is conserved. Substances can be categorized and grouped based on similari[illegible] reactivity (for example metals). (National Science Education Standards, November 1994.)

Material Technology

societies use the understanding of physical and chemical change to create new and useful products. The production of these materials has social, environmental, and other implications that require analyses of the risks and benefits.

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PERFORMANCE INDICATORS
Materials and Their Properties

Grade Six

Topic: Investigating the Rock Cycle as Evidence of a Changing Earth

Students will be able to:

6.313 identify and classify rocks and minerals according to their physical and chemical properties.

6.316 classify unknown rock samples (e.g., igneous, sedimentary, or metamorphic) based on identifiable characteristics. Explain how this method of classifying is related to the rocks formation.

Topic: Developing Criteria for Classifying Living and Nonliving Things

Students will be able to:

6.341 explain how physical properties (e.g., size, shape, color, texture, hardness) and characteristic properties (e.g., boiling points, melting points, solubility, density, conductivity, pH) can be used to classify and sort objects or nonliving things.

6.342 distinguish between the physical properties and characteristic properties of an object or material.

Grade Seven

Topic: Using Physical and Chemical Properties to Distinguish and Separate Mixtures and Solutions

Students will be able to:

7.301 distinguish between the physical properties (e.g., size, shape, color, texture, hardness) and characteristic properties (e.g., boiling point, melting point, solubility, density, conductivity, pH) of a substance or material.

7.302 observe, measure, and compare characteristic properties of a variety of substances (e.g., how does an object's density determine whether it sinks or floats).

7.303 use physical and characteristic properties to distinguish and separate one substance or material from another.

7.304 identify common materials found in the classroom or at home which are mixtures or solutions and conduct investigations to determine the components of those mixtures or solutions (e.g., chromatography, reading labels).

7.305 conduct investigations to identify factors that affect the rate of solubility.

Grade Eight

Topic: Investigating How Energy Transformations Drive Physical, Chemical, and Biological Processes

Students will be able to:

8.304 conduct simple investigations with a variety of materials (sand, water, cloth, objects) to describe and measure the effects (including both physical and chemical changes) of light energy on these materials.

8.310 describe and demonstrate how light energy interacts with a variety of materials by transmission (including refraction), absorption, and scattering (including reflection). Explain how interactions with materials account for a range of phenomena observed (colors of objects, changes of state, light from the Moon).

8.311 conduct investigations to determine how the physical properties (e.g., size, shape, color, texture, hardness) and characteristic properties (e.g., boiling points, melting points, solubility) of materials can account for the degree of change observed in the materials when they interact with the same amount of energy. (For example: dark cloth absorbs more heat than light cloth, clear water transmits more light than murky water, water retains heat longer than sand, shiny material reflects more light than dull material.)

SCIENCE STANDARD TWO

Materials and Their Properties

END OF CLUSTER EXPECTATIONS

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Transformation and Conservation of Matter

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PERFORMANCE INDICATORS
Materials and Their Properties

Grade Six	Grade Seven	Grade Eight
Topic: Developing Criteria for Classifying Living and Nonliving Things (continued) **Students will be able to:** 6.343 conduct investigations to determine the difference between melting and dissolving (characteristic properties). Recognize that melting requires only one substance while dissolving requires two substances. 6.344 conduct investigations to determine that different pure substances melt or boil at different temperatures and that these differences can be used to classify or sort objects, materials or substances. 6.345 classify a variety of materials or substances according to whether or not they dissolve in specific solvents. 6.346 use the characteristic property of conductivity to classify a variety of objects, materials, or substances as either conductors or insulators. 6.347 explain how the physical properties of materials and substances determine how the material or substance is used.	**Topic: Using Physical and Chemical Properties to Distinguish and Separate Mixtures and Solutions (continued)** **Students will be able to:** 7.306 use ratios and percentages to prepare solutions of different concentrations. 7.307 demonstrate that when a solute dissolves in a solvent the dissolved substance does not disappear but is added to the mass of the solvent. 7.308 investigate and discuss why the measurements of specific components of a physical mixture are reported to people (e.g., particles in the air, cholesterol in blood, unsaturated fats in foods, turbidity in lakes) and how the measurements are used to monitor health problems and or environmental pollutants. 7.309 develop investigations or use models to explore how solutions spread or move from an area of higher concentration to one of lower concentrations. 7.310 investigate what types of barriers (e.g., cell membrane, soil types) would prohibit or prevent the movement of a solution from one area to another.	

SCIENCE STANDARD TWO

Materials and Their Properties

END OF CLUSTER EXPECTATIONS

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PERFORMANCE INDICATORS
Materials and Their Properties

Grade Six	Grade Seven	Grade Eight
	Topic: Understanding the Importance of Protecting Delaware Watersheds **Students will be able to:** 7.339 recognize that water is a solvent and as it passes through the water cycle it dissolves minerals, gases, and pollutants and carries them to surface water and ground water supplies. 7.341 conduct tests (e.g., pH, dissolved oxygen) or surveys (e.g., macroinvertebrate) to determine the ecological health and potability of local water samples.	

SCIENCE STANDARD THREE

Energy and Its Effects

END OF CLUSTER EXPECTATIONS

By the end of grade 8, students will know that:

Forms/Sources of Energy

the electromagnetic spectrum is composed of different wavelength domains. The radiation in this spectrum comes from various sources and spans energy levels from radio waves (longest wavelengths, lowest energy) through microwaves, infrared, visible, ultraviolet, x-rays, to gamma rays (shortest wavelengths, highest energy). White light from the Sun consists of a mixture of wavelengths and energies in the visible part of the electromagnetic spectrum (red to violet).

electrical energy results from the movement of electric charges (electrons) driven by a voltage through a complete circuit. Electrical energy can be readily generated, transmitted over great distances, and transformed into heat, light, sound, and motion. Electrical systems can be designed to perform a variety of tasks, using series, parallel, or combination circuits.

static electricity represents potential energy stored in a collection of separated negative and positive charges. Similar charges repel each other,; opposite charges attract each other and can lead to a sudden flow of electrons (e.g., a spark, a lightening bolt).

chemical energy is stored in elements and compounds. In most chemical reactions, energy is released or added to the system in the form of heat, light, electrical, or mechanical energy. (National Science Education Standards, 1994)

Forces and Motion

forces must be used to change speed or direction (or both) of a moving object. In the absence of such a force, the object will continue to move with the same speed and in the same direction. Forces have directions and magnitudes that can be measured. Any change in motion depends upon the amount of force causing the change and the mass of the object.

Interactions of Energy With Materials

energy can travel as waves which are characterized by wavelength, frequency, amplitude, and speed. Waves have common properties of absorption, reflection, and refraction when they interact with matter. They are either mechanical (e.g., sound, earthquake, tidal) or electromagnetic (e.g., sunlight, radio waves); only electromagnetic waves will travel through a vacuum.

mechanical energy comes from the motion and/or the position of physical objects. The work done on an object depends on the applied force and on the distance that the object moves.

the motion of an object can be described as its change in position, direction, and speed relative to another object.

simple machines (e.g., levers, inclines, pulleys, gears) are used to change the force on an object and its speed or direction in order to make work easier.

Transformation and Conservation of Energy

almost all events in the Universe involve the transformation of one form of energy into another form with the release of heat. Regardless of the transformation, the total amount of energy remains constant.

heat energy is transported through materials by conduction, by convection in fluids (e.g., air or water), or across space by radiation. The addition or removal of heat from a material changes its temperature or its physical state (e.g., ice melting). the resistance to flow of an electric current through a material depends on the mobility of electrons in the material. In conductors (e.g. metals) the electrons flow easily, while in insulators (e.g., wood, glasses) they flow hardly at all. The resistance to flow converts electric energy to heat energy.

Production/Consumption/Application of Energy

technological advances throughout history (e.g. electric light, steam engine, internal combustion engine, radio, TV) have led to new applications which use different forms of energy. Such advances have led to increased demand for energy, and in some cases, unanticipated effects on society.

energy is obtained from a variety of sources, some of which are finite and some of which are renewable. The major source of energy for society is chemical energy stored in fossil fuels created many years ago through the process of photosynthesis. Another source is nuclear energy. Renewable sources (e.g., wind, geothermal, waves, biomass) vary in their availability and ease of use.

most energy used by industrial societies is derived from fossil fuel sources. Such sources are inherently limited on the earth and are unevenly distributed geographically. Responsible use of energy requires consideration of energy availability, efficiency, environmental issues, and alternative sources.

The areas listed above will serve as the basis for Science assessment items in the Delaware Student Testing Program.

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PERFORMANCE INDICATORS

Energy and Its Effects

Grade Six

Topic: Building an Understanding of Forces That Cause Motion

Students will be able to:

6.324 conduct investigations to demonstrate that a force causes a resting object to move, brings a moving object to rest or changes the direction of a moving object.

6.325 calculate an objects average speed (average speed = distance ÷ time) when forces of different magnitudes are applied to initiate the objects motion.

6.326 observe and compare the speed of objects when forces such as friction are varied.

6.327 explain and demonstrate how common tools (e.g., pliers, crowbars, hammers, pulleys, can openers) incorporate simple machines in their designs. Discuss the forces and motions involved.

6.328 use simple machine principles to design a device which performs a task (e.g., lift a weight, move a heavy object). Explain the forces and motions involved.

6.329 conduct investigations to determine how invisible forces such as magnetism and static electricity can cause objects to move.

6.330 construct series, p[illegible]el, and combination circuits to demonstrate the flow of electricity.

Grade Seven

Topic: Investigating the Cellular Dimensions of Living Systems

Students will be able to:

7.318 recognize that for multicellular organisms, most interactions that sustain life take place at the cellular level. Explain how the energy and materials needed by cells to perform work and to build new materials are derived from the food and oxygen taken in by the organism.

7.319 select several human body systems and explain how they interact to transport the food and oxygen required by all cells to perform work and to build new materials.

Grade Eight

Topic: Investigating How Energy Transformations Drive Physical, Chemical, and Biological Processes

Students will be able to:

8.301 explain that the source of almost all of the Earth's energy is light from the Sun which travels to Earth in a range of wavelengths.

8.302 identify and describe the differences in energy levels associated with visible light, infrared, and ultraviolet radiation.

8.303 demonstrate the existence of the color components of visible light using a prism or diffraction grating. Explain the colors and their order in terms of energy and wavelengths.

8.304 conduct simple investigations with a variety of materials (sand, water, cloth, objects) to describe and measure the effects (including both physical and chemical changes) of light energy on these materials.

8.305 trace what happens when light energy from the Sun encounters various materials or mediums, such as, atmosphere, oceans, Earth's surface, objects, plants, and animals. Recognize that the effect of light energy on these materials or mediums is not uniform.

SCIENCE STANDARD THREE

Energy and Its Effects

END OF CLUSTER EXPECTATIONS

By the end of grade 8, students will know that:

Forms/Sources of Energy

the electromagnetic spectrum is composed of different wavelength domains. The radiation in this spectrum comes from various sources and spans energy levels from radio waves (longest wavelengths, lowest energy) through microwaves, infrared, visible, ultraviolet, x-rays, to gamma rays (shortest wavelengths, highest energy). White light from the Sun consists of a mixture of wavelengths and energies in the visible part of the electromagnetic spectrum (red to violet).

electrical energy results from the movement of electric charges (electrons) driven by a voltage through a complete circuit. Electrical energy can be readily generated, transmitted over great distances, and transformed into heat, light, sound, and motion. Electrical systems can be designed to perform a variety of tasks, using series, parallel, or combination circuits.

static electricity represents potential energy stored in a collection of separated negative and positive charges. Similar charges repel each other,; opposite charges attract each other and can lead to a sudden flow of electrons (e.g., a spark, a lightening bolt).

chemical energy is stored in elements and compounds. In most chemical reactions, energy is released or added to the system in the form of heat, light, electrical, or mechanical energy. (National Science Education Standards, 1994)

Forces and Motion

forces must be used to change speed or direction (or both) of a moving object. In the absence of such a force, the object will continue to move with the same speed and in the same direction. Forces have directions and magnitudes that can be measured. Any change in motion depends upon the amount of force causing the change and the mass of the object.

Interactions of Energy With Materials

energy can travel as waves which are characterized by wavelength, frequency, amplitude, and speed. Waves have common properties of absorption, reflection, and refraction when they interact with matter. They are either mechanical (e.g., sound, earthquake, tidal) or electromagnetic (e.g., sunlight, radio waves); only electromagnetic waves will travel through a vacuum.

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Transformation and Conservation of Energy

almost all events in the Universe involve the transformation of one form of energy into another form with the release of heat. Regardless of the transformation, the total amount of energy remains constant.

heat energy is transported through materials by conduction, by convection in fluids (e.g., air or water), or across space by radiation. The addition or removal of heat from a material changes its temperature or its physical state (e.g., ice melting). the resistance to flow of an electric current through a material depends on the mobility of electrons in the material. In conductors (e.g. metals) the electrons flow easily, while in insulators (e.g., wood, glasses) they flow hardly at all. The resistance to flow converts electric energy to heat energy.

Production/Consumption/Application of Energy

technological advances throughout history (e.g. electric light, steam engine, internal combustion engine, radio, TV) have led to new applications which use different forms of energy. Such advances have led to increased demand for energy, and in some cases, unanticipated effects on society.

energy is obtained from a variety of sources, some of which are finite and some of which are renewable. The major source of energy for society is chemical energy stored in fossil fuels created many years ago through the process of photosynthesis. Another source is nuclear energy. Renewable sources (e.g., wind, geothermal, waves, biomass) vary in their availability and ease of use.

most energy used by industrial societies is derived from fossil fuel sources. Such sources are inherently limited on the earth and are unevenly distributed geographically. Responsible use of energy requires consideration of energy availability, efficiency, environmental issues, and alternative sources.

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PERFORMANCE INDICATORS
Energy and Its Effects

Grade Six

Topic: Building an Understanding of Forces That Cause Motion (continued)

Students will be able to:

6.331 demonstrate that an electric current moving through a wire produces magnetism and that an electric current can be generated by placing a rotating coil of wire near a magnet.

6.332 design simple investigations to determine the effect different variables (number of turns of wire around the core, the material that the core is made of, diameter of the core) have on electromagnetic strength.

6.333 describe how the motors in electrical appliances operate to convert electricity into mechanical work.

6.334 compile a list of ways electric motors can be used to perform different kinds of hard work and describe how the use of electricity has changed our lives.

Grade Seven

Grade Eight

Topic: Investigating How Energy Transformations Drive Physical, Chemical, and Biological Processes (continued)

Students will be able to:

8.306 conduct simple investigations to demonstrate that heat flows from one object to another in predictable ways, from warmer objects to cooler ones, until both reach the same temperature.

8.307 explain how uneven heating of Earth's components – water, land, air – produces global atmospheric and oceanic movement. Describe how these global patterns of movement influence weather and climate.

8.308 use models to explain how variations in the amount of sun's energy hitting the Earth's surface results in seasons.

8.309 use a variety of models, charts, diagrams, or simple investigations to explain how the Sun's energy causes water to cycle through the Earth's crust, oceans, and atmosphere.

8.310 describe and demonstrate how light energy interacts with a variety of materials by transmission (including refraction), absorption, and scattering (including reflection). Explain how interactions with materials account for a range of phenomena observed (colors of objects, changes of state, light from the moon).

SCIENCE STANDARD THREE

Energy and Its Effects

END OF CLUSTER EXPECTATIONS

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PERFORMANCE INDICATORS
Energy and Its Effects

Grade Six	Grade Seven	Grade Eight
		Topic: Investigating How Energy Transformations Drive Physical, Chemical, and Biological Processes (continued) **Students will be able to:** 8.311 conduct investigations to determine how the physical properties (e.g., size, shape, color, texture, hardness) and characteristic properties (e.g., boiling points, melting points, solubility) of materials can account for the degree of change observed in the materials when they interact with the same amount of energy. (For example, dark cloth absorbs more heat than light cloth, clear water transmits more light than murky water, water retains heat longer than sand, shiny material reflects more light than dull material.) 8.312 recognize that forces result from the transformation of energy and can be constructive or destructive. Both constructive forces (e.g., volcanic eruptions and deposition of sediment) and destructive forces (e.g., weathering and erosion) shape the Earth's surface. 8.313 conduct simple investigations to determine how constructive and destructive forces alter the surface of the Earth (e.g., build model glaciers, formation of river beds, stream tables that model weathering and erosion, model wind erosion, etc.)

SCIENCE STANDARD THREE

Energy and Its Effects

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the electromagnetic spectrum is composed of different wavelength domains. The radiation in this spectrum comes from various sources and spans energy levels from radio waves (longest wavelengths, lowest energy) through microwaves, infrared, visible, ultraviolet, x-rays, to gamma rays (shortest wavelengths, highest energy). White light from the Sun consists of a mixture of wavelengths and energies in the visible part of the electromagnetic spectrum (red to violet).

electrical energy results from the movement of electric charges (electrons) driven by a voltage through a complete circuit. Electrical energy can be readily generated, transmitted over great distances, and transformed into heat, light, sound, and motion. Electrical systems can be designed to perform a variety of tasks, using series, parallel, or combination circuits.

static electricity represents potential energy stored in a collection of separated negative and positive charges. Similar charges repel each other,; opposite charges attract each other and can lead to a sudden flow of electrons (e.g., a spark, a lightening bolt).

chemical energy is stored in elements and compounds. In most chemical reactions, energy is released or added to the system in the form of heat, light, electrical, or mechanical energy. (National Science Education Standards, 1994)

Forces and Motion

forces must be used to change speed or direction (or both) of a moving object. In the absence of such a force, the object will continue to move with the same speed and in the same direction. Forces have directions and magnitudes that can be measured. Any change in motion depends upon the amount of force causing the change and the mass of the object.

Interactions of Energy With Materials

energy can travel as waves which are characterized by wavelength, frequency, amplitude, and speed. Waves have common properties of absorption, reflection, and refraction when they interact with matter. They are either mechanical (e.g., sound, earthquake, tidal) or electromagnetic (e.g., sunlight, radio waves); only electromagnetic waves will travel through a vacuum.

mechanical energy comes from the motion and/or the position of physical objects. The work done on an object depends on the applied force and on the distance that the object moves.

the motion of an object can be described as its change in position, direction, and speed relative to another object.

simple machines (e.g., levers, inclines, pulleys, gears) are used to change the force on an object and its speed or direction in order to make work easier.

Transformation and Conservation of Energy

almost all events in the Universe involve the transformation of one form of energy into another form with the release of heat. Regardless of the transformation, the total amount of energy remains constant.

heat energy is transported through materials by conduction, by convection in fluids (e.g., air or water), or across space by radiation. The addition or removal of heat from a material changes its temperature or its physical state (e.g., ice melting). the resistance to flow of an electric current through a material depends on the mobility of electrons in the material. In conductors (e.g. metals) the electrons flow easily, while in insulators (e.g., wood, glasses) they flow hardly at all. The resistance to flow converts electric energy to heat energy.

Production/Consumption/Application of Energy

technological advances throughout history (e.g. electric light, steam engine, internal combustion engine, radio, TV) have led to new applications which use different forms of energy. Such advances have led to increased demand for energy, and in some cases, unanticipated effects on society.

energy is obtained from a variety of sources, some of which are finite and some of which are renewable. The major source of energy for society is chemical energy stored in fossil fuels created many years ago through the process of photosynthesis. Another source is nuclear energy. Renewable sources (e.g., wind, geothermal, waves, biomass) vary in their availability and ease of use.

most energy used by industrial societies is derived from fossil fuel sources. Such sources are inherently limited on the earth and are unevenly distributed geographically. Responsible use of energy requires consideration of energy availability, efficiency, environmental issues, and alternative sources.

The areas listed above will serve as the basis for Science assessment items in the Delaware Student Testing Program.

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PERFORMANCE INDICATORS
Energy and Its Effects

Grade Six	Grade Seven	Grade Eight
		Topic: Investigating How Energy Transformations Drive Physical, Chemical, and Biological Processes (continued) **Students will be able to:** 8.314 trace the transfer of energy across several events or sequence of actions to demonstrate an understanding that even though energy is transferred from one form to another, the total amount of energy is conserved (e.g., Sun's heat → unequal heating of air → wind → windmills → electricity → light bulb → light and heat → eye OR Sun energy → plant → sugar → food for horse → digested → particles going to cells → cells do work → use horse to plow fields → plant seeds → Sun energy → sugar etc., etc., etc.) **Topic: Explaining How the Sun's Energy Drives Earth's Weather and Climate** **Students will be able to:** 8.316 explain the role of the atmosphere's ozone layer in absorbing harmful ultraviolet radiation. 8.320 examine isobars on weather maps to describe how wind (moving air) travels from a region of high pressure to a region of low pressure. 8.321 examine maps of ocean currents and trace the origin and flow of such currents to explain the transfer of heat energy. Identify which currents have dominant influence on the Delaware Coast. 8.323 use diagrams or simulations of the hydrologic cycle to describe the Sun's effect on the water cycle and to describe the circulation of water through the Earth's crust, oceans, and atmosphere.

SCIENCE STANDARD THREE

Energy and Its Effects

END OF CLUSTER EXPECTATIONS

By the end of **grade 8**, students will know that:

Forms/Sources of Energy

the electromagnetic spectrum is composed of different wavelength domains. The radiation in this spectrum comes from various sources and spans energy levels from radio waves (longest wavelengths, lowest energy) through microwaves, infrared, visible, ultraviolet, and x-rays, to gamma rays (shortest wavelengths, highest energy). White light from the Sun consists of a mixture of wavelengths and energies in the visible part of the electromagnetic spectrum (red to violet).

electrical energy results from the movement of electric charges (electrons) driven by a voltage through a complete circuit. Electrical energy can be readily generated, transmitted over great distances, and transformed into heat, light, sound, and motion. Electrical systems can be designed to perform a variety of tasks, using series, parallel, or combination circuits.

static electricity represents potential energy stored in a collection of separated negative and positive charges. Similar charges repel each other; opposite charges attract each other and can lead to a sudden flow of electrons (e.g., a spark, a lightening bolt).

chemical energy is stored in elements and compounds. In most chemical reactions, energy is released or added to the system in the form of heat, light, electrical, or mechanical energy. (National Science Education Standards, 1994)

Forces and Motion

forces must be used to change speed or direction (or both) of a moving object. In the absence of such a force, the object will continue to move with the same speed and in the same direction. Forces have directions and magnitudes that can be measured. Any change in motion depends upon the amount of force causing the change and the mass of the object.

Interactions of Energy With Materials

energy can travel as waves which are characterized by wavelength, frequency, amplitude, and speed. Waves have common properties of absorption, reflection, and refraction when they interact with matter. They are either mechanical (e.g., sound, earthquake, tidal) or electromagnetic (e.g., sunlight, radio waves); only electromagnetic waves will travel through a vacuum.

mechanical energy comes from the motion and/or the position of physical objects. The work done on an object depends on the applied force and on the distance that the object moves.

the motion of an object can be described as its change in position, direction, and speed relative to another object.

simple machines (e.g., levers, inclines, pulleys, gears) are used to change the force on an object and its speed or direction in order to make work easier.

Transformation and Conservation of Energy

almost all events in the universe involve the transformation of one form of energy into another form with the release of heat. Regardless of the transformation, the total amount of energy remains constant.

heat energy is transported through materials by conduction, by convection in fluids (e.g., air or water), or across space by radiation. The addition or removal of heat from a material changes its temperature or its physical state (e.g., ice melting). The resistance to flow of an electric current through a material depends on the mobility of electrons in the material. In conductors (e.g., metals) the electrons flow easily, while in insulators (e.g., wood, glasses) they flow hardly at all. The resistance to flow converts electric energy to heat energy.

Production/Consumption/Application of Energy

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PERFORMANCE INDICATORS
Energy and Its Effects

Grade Six	Grade Seven	Grade Eight
		Topic: Constructing Models That Explain the Visual and Physical Relationships Among the Earth, Sun, Moon, and the Solar System **Students will be able to:** 8.327 demonstrate an understanding of our solar system which includes the moon, the sun, eight other planets and their moons, and smaller objects such as asteroids and comets. Explain how the sun is the central and largest body in our solar system and the source of the light energy that hits our planet. 8.330 explain how the force of gravity keeps planets in orbit around the sun. **Topic: Tracking Growth, Change, and Adaptations in Ecosystems Over Time** **Students will be able to:** 8.339 construct food webs and identify the relationships among producers, consumers, and decomposers. 8.340 design food webs and trace the flow of matter and energy (beginning with the Sun) through the food web. Recognize that energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis.

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SCIENCE STANDARD FOUR

Earth in Space

END OF CLUSTER EXPECTATIONS

By the end of grade 8 students will know that:

Solar Systems Models

the universe is composed of billions of stars. The Sun is a medium size star which is many millions of miles closer to Earth than the next nearest star.

the solar system forms part of the Milky Way Galaxy, which is one of many galaxies that comprise the Universe. Some of the galaxies are so far away that their light takes billions of years to reach Earth.

the nine planets, their respective moon(s), comets and many asteroids, and meteorites orbit the Sun which is the gravitational center of the solar system.

the apparent shape of the Moon changes dramatically as it moves in its orbit. These shapes, called phases, relate to lunar visibility and the times at which the Moon rises and sets. The Moon produces no light of its own and shines only as a result of sunlight reflected from its surface.

the yearly revolution of Earth in its orbit about the Sun and the tilt of Earth on its axis (23.5 degrees) cause the angle at which sunlight strikes the Earth to vary at different locations. This causes differences in the heating of Earth's surface which produce seasonal variations in weather and a variety of climates.

Interactions in the Solar System

nuclear processes that take place in the Sun continuously convert matter to energy. A small portion of this energy which is intercepted by Earth drives biological, chemical, and physical process on Earth.

the gravitational attraction that exists between all forms of matter holds objects on Earth, causes tides, keeps the solar system and galaxy together, and controls the movement of the planets in the solar system.

Technology and Applications

close-up pictures and data received from space probes allow scientists to compare the physical properties of planets (e.g., size, surface features, number of rings) and to speculate about conditions on other planets.

The areas listed above will serve as the basis for Science assessment items in the Delaware Student Testing Program.

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PERFORMANCE INDICATORS

Earth in Space

Grade Six	Grade Seven	Grade Eight
		Topic: Constructing Models that Explain the Visual and Physical Relationships Among the Earth, Sun, Moon, and the Solar System **Students will be able to:** 8.327 demonstrate an understanding of our solar system which includes the Moon, the Sun, eight other planets and their moons, and smaller objects such as asteroids and comets. Explain how the Sun is the central and largest body in our solar system and the source of the light energy that hits our planet. 8.328 use models, charts, illustrations, and other suitable representations to predict regular patterns of motion for most objects in the solar system. 8.329 model and explain how the regular and predictable motion of most objects in the solar system is responsible for observed phenomena such as day/night and the year. Use models to show how the motion of the Moon about the Earth and the location of the Sun relative to the Earth and its Moon explains the regular patterns of phases of the Moon, eclipses, and tides. 8.330 explain how the force of gravity keeps planets in orbit around the sun.

SCIENCE STANDARD FOUR

Earth in Space

END OF CLUSTER EXPECTATIONS

By the end of grade 8 students will know that:

Solar Systems Models

the universe is composed of billions of stars. The Sun is a medium size star which is many millions of miles closer to Earth than the next nearest star.

the solar system forms part of the Milky Way Galaxy, which is one of many galaxies that comprise the Universe. Some of the galaxies are so far away that their light takes billions of years to reach Earth.

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Technology and Applications

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The areas listed above will serve as the basis for Science assessment items in the Delaware Student Testing Program.

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PERFORMANCE INDICATORS

Earth in Space

Grade Six	Grade Seven	Grade Eight
		Topic: Constructing Models that Explain the Visual and Physical Relationships Among the Earth, Sun, Moon, and the Solar System (continued) **Students will be able to:** 8.331 construct scale models of the solar system in order to describe the relative sizes of planets (as viewed from Earth) and their distances from the Sun. Understand how a telescope magnifies the appearance of certain objects in the sky, including the Moon and the planets. 8.332 use a variety of resources (e.g., NASA photographs, computer simulations, satellite images) to compare and contrast the physical properties (e.g., temperature, size, composition, surface features) of planets. Use this information to explain why Earth is a suitable planet for life. 8.333 study a space probe mission and the evidence it provides scientists that either confirms or refutes theories about conditions on other planets. 8.334 observe and demonstrate that patterns of stars only appear to move across the sky and that different stars can be seen at different times of the year. 8.335 investigate how some people have used the movement of objects in the sky in order to tell time and location. 8.336 use scale drawings, models, or triangulation to determine the distance between specific points in the solar system.

SCIENCE STANDARD FIVE

Earth's Dynamic Systems

END OF CLUSTER EXPECTATIONS

By the end of grade 8, students will know that:

Components of Earth

rocks and minerals are classified according to their chemical and physical properties. Rocks also are classified according to how they are formed.

sedimentary rocks, which are made of particles from other rocks and organic remains, are laid down in horizontal layers. Fossilized remains and successive layering of sedimentary rocks provide evidence of the Earth's history. Absolute age is determined by radioactive dating.

the atmosphere has properties that can be observed, measured, and used to predict changes in weather and to identify climatic patterns.

water falling to Earth flows over the surface as run-off and collects in ocean basins, rivers, lakes, ice caps, and underground. Water stored underground (subsurface) and water stored above ground (surface) form a continuum, each supplying water to the other. Human activity and natural events can introduce chemicals affecting the quality of water supply.

Interactions Among Earth's Systems

volcanoes, earthquakes, and other mountain-building processes are responsible for most major features of the Earth's crust.

rocks are changed by erosion and deposition and by exposure to heat and pressure. There are a variety of physical and chemical processes that lead to the decomposition and breakdown of rocks and the eventual formation of soils and sediments. These soils and sediments can then be transported to other places by wind, flowing water, waves, and ice.

the cycling of water in the atmosphere is driven by energy transfer processes, such as convection and radiation, and is constantly changing the location and phase of water.

uneven heating and cooling of Earth's surface produce various air masses which differ in density, humidity, and temperature. The origin, movement, and interaction of these air masses result in significant weather changes.

ocean currents affect the weather and long-term climatic patterns of a region. Large bodies of water (oceans, the Great Lakes, inland seas) can also affect the weather and climate of an area.

Technology and Applications

instrumentation (e.g., pH meters, water analysis kits) and computer models enable the measurement and analysis of environmental pollution. Sources of environmental pollution can be tracked using maps and satellite imagery.

The areas listed above will serve as the basis for Science assessment items in the Delaware Student Testing Program.

PERFORMANCE INDICATORS
Earth's Dynamic Systems

Grade Six

Topic: Investigating the Rock Cycle as Evidence of a Changing Earth

Students will be able to:

6.313 identify and classify rocks and minerals according to their physical and chemical properties.

6.314 explain the difference between minerals (a relatively pure substance that occurs in the Earth and has a crystalline form) and rocks (a combination of different minerals).

6.315 create models of rock formation to investigate how igneous, sedimentary, and metamorphic rocks are formed.

6.316 classify unknown rock samples (e.g., igneous, sedimentary, or metamorphic) based on identifiable characteristics. Explain how this method of classifying is related to the rock's formation.

6.317 investigate factors that cause weathering of rocks. (e.g., exposure to wind, precipitation, temperature changes, plant growth, acid rain, etc.).

Grade Seven

Topic: Understanding the Importance of Protecting Delaware Watersheds

Students will be able to:

7.336 use maps to locate Delaware watersheds and to identify the bodies of water into which they drain.

7.337 use models or diagrams to explain how water stored underground and water stored above ground form a continuum each supplying water to the other.

7.338 use diagrams of the hydrologic cycle to describe the circulation of water through the Earth's crust, oceans, and atmosphere.

7.339 recognize that water is a solvent and as it passes through the water cycle it dissolves minerals, gases, and pollutants and carries them to surface water and ground water supplies.

7.340 identify the sources of drinking water for the citizens of Delaware.

Grade Eight

Topic: Investigating How Energy Transformations Drive Physical, Chemical, and Biological Processes

Students will be able to:

8.307 explain how uneven heating of earth's components – water, land, air – produce global atmospheric and oceanic movement. Describe how these global patterns of movement influence weather and climate.

8.308 use models to explain how variations in the amount of Sun's energy hitting the Earth's surface results in seasons.

8.309 use a variety of models, charts, diagrams, or simple investigations to explain how the Sun's energy causes water to cycle through the Earth's crust, oceans, and atmosphere.

8.312 recognize that forces result from the transformation of energy and can be constructive or destructive. Both constructive forces (e.g., volcanic eruptions and deposition of sediment) and destructive forces (e.g., weathering and erosion) shape the Earth's surface.

SCIENCE STANDARD FIVE

Earth's Dynamic Systems

END OF CLUSTER EXPECTATIONS

By the end of grade 8, students will know that:

Components of Earth

rocks and minerals are classified according to their chemical and physical properties. Rocks also are classified according to how they are formed.

sedimentary rocks, which are made of particles from other rocks and organic remains, are laid down in horizontal layers. Fossilized remains and successive layering of sedimentary rocks provide evidence of the Earth's history. Absolute age is determined by radioactive dating.

the atmosphere has properties that can be observed, measured, and used to predict changes in weather and to identify climatic patterns.

water falling to Earth flows over the surface as run-off and collects in ocean basins, rivers, lakes, ice capes, and underground. Water stored underground (sub-surface) and water stored above ground (surface) form a continuum, each supplying water to the other. Human activity and natural events can introduce chemicals affecting the quality of water supply.

Interactions Among Earth's Systems

volcanoes, earthquakes, and other mountain-building processes are responsible for most major features of the Earth's crust.

rocks are changed by erosion and deposition and by exposure to heat and pressure. There are a variety of physical and chemical processes that lead to the decomposition and breakdown of rocks and the eventual information of soils and sediments. These soils and sediments can then be transported to other places by wind, flowing water, waves, and ice.

the cycling of water in the atmosphere is driven by energy transfer processes, such as convection and radiation, and is constantly changing the location and phase of water.

uneven heating and cooling of Earth's surface produce various air masses which differ in density, humidity, and temperature. The origin, movement, and interaction of these air masses result in significant weather changes.

ocean currents affect the weather and long term climatic patterns of a region. Large bodies of water (oceans, the Great Lakes, inland seas) can also affect the weather and climate of an area.

Technology and Applications

instrumentation (e.g., pH meters, water analysis kits) and computer models enable the measure and analysis of environmental pollution. Sources of environmental pollution can be tracked using maps and satellite imagery.

The areas listed above will serve as the basis for Science assessment items in the Delaware Student Testing Program.

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PERFORMANCE INDICATORS
Earth's Dynamic Systems

Grade Six

Topic: Investigating the Rock Cycle as Evidence of a Changing Earth (continued)

Students will be able to:

6.318 survey the local area (e.g., walk around the school building, visit a cemetery) to observe, describe and explain the visual and structural effects of weathering on both natural and manmade rock structures.

6.319 examine soil samples to identify and discuss factors that determine soil composition and structure (type of underlying rocks, climate, sorts of vegetation present).

6.320 investigate how rocks are cycled through the processes of weathering, erosion, transport, and deposition.

6.321 conduct simulations to demonstrate how erosion (e.g., beach erosion) and deposition of rock and soil (e.g., beach formation) lead to the development of land forms.

6.322 recognize that successive layers of sedimentary rock and the fossilized remains found in those layers confirm Earth's long history.

Grade Seven

Topic: Understanding the Importance of Protecting Delaware Watersheds (continued)

Students will be able to:

7.341 conduct tests (e.g., pH, dissolved oxygen) or surveys (e.g., macroinvertebrate) to determine the ecological health and potability of local water samples.

7.342 conduct investigations to determine the extent to which the permeability and porosity of a soil sample effect water percolation.

7.343 describe the role of wetlands and streamside forests (riparian) in filtering water as it runs off into local streams, rivers, and bays or seeps into ground water.

7.344 distinguish between point source water pollutants and non-point source water pollutants.

7.345 explain the impact of human activities (e.g., farming, building roads, fertilizing golf courses, etc.) on the quality of Delaware's waters.

7.346 research the processes used by municipalities to ensure water taken from local reservoirs is safe to drink.

Grade Eight

Topic: Investigating How Energy Transformations Drive Physical, Chemical, and Biological Processes (continued)

Students will be able to:

8.313 conduct simple investigations to determine how constructive and destructive forces alter the surface of the earth (e.g., build model glaciers, formation of river beds, stream tables that model weathering and erosion, model wind erosion, etc.)

Topic: Explaining How the Sun's Energy Drives Earth's Weather and Climate

Students will be able to:

8.315 verify that the atmosphere has properties that can be observed, measured, and used to predict changes in weather. Recognize that the atmosphere has different properties at different elevations.

8.316 explain the role of the atmosphere's ozone layer in absorbing harmful ultraviolet radiation.

8.317 record and interpret daily weather measurements over an extended period of time using a variety of instruments (e.g., barometer, anemometer, sling psychometer, etc.) in order to predict and to identify weather patterns.

SCIENCE STANDARD FIVE

Earth's Dynamic Systems

END OF CLUSTER EXPECTATIONS

By the end of grade 8, students will know that:

Components of Earth

rocks and minerals are classified according to their chemical and physical properties. Rocks also are classified according to how they are formed.

sedimentary rocks, which are made of particles from other rocks and organic remains, are laid down in horizontal layers. Fossilized remains and successive layering of sedimentary rocks provide evidence of the Earth's history. Absolute age is determined by radioactive dating.

the atmosphere has properties that can be observed, measured, and used to predict changes in weather and to identify climatic patterns.

water falling to Earth flows over the surface as run-off and collects in ocean basins, rivers, lakes, ice capes, and underground. Water stored underground (sub-surface) and water stored above ground (surface) form a continuum, each supplying water to the other. Human activity and natural events can introduce chemicals affecting the quality of water supply.

Interactions Among Earth's Systems

volcanoes, earthquakes, and other mountain-building processes are responsible for most major features of the Earth's crust.

rocks are changed by erosion and deposition and by exposure to heat and pressure. There are a variety of physical and chemical processes that lead to the decomposition and breakdown of rocks and the eventual information of soils and sediments. These soils and sediments can then be transported to other places by wind, flowing water, waves, and ice.

the cycling of water in the atmosphere is driven by energy transfer processes, such as convection and radiation, and is constantly changing the location and phase of water.

uneven heating and cooling of Earth's surface produce various air masses which differ in density, humidity, and temperature. The origin, movement, and interaction of these air masses result in significant weather changes.

ocean currents affect the weather and long term climatic patterns of a region. Large bodies of water (oceans, the Great Lakes, inland seas) can also affect the weather and climate of an area.

Technology and Applications

instrumentation (e.g., pH meters, water analysis kits) and computer models enable the measure and analysis of environmental pollution. Sources of environmental pollution can be tracked using maps and satellite imagery.

The areas listed above will serve as the basis for Science assessment items in the Delaware Student Testing Program.

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PERFORMANCE INDICATORS
Earth's Dynamic Systems

Grade Six

Topic: Investigating the Rock Cycle as Evidence of a Changing Earth (continued)

Students will be able to:

6.323 compare and contrast fossils and anatomical models to draw reasonable conclusions regarding evolutionary change over time (e.g., trilobites → horseshoe crabs, belemnites → squid)

Grade Seven

Topic: Understanding the Importance of Protecting Delaware Watersheds (continued)

Students will be able to:

7.347 investigate the extent to which legislation such as the Clean Water Act has impacted the quality of Delaware water.

Grade Eight

Topic: Explaining How the Sun's Energy Drives Earth's Weather and Climate (continued)

Students will be able to:

8.318 classify clouds according to their characteristics and explain how clouds formed by condensation affect weather and climate.

8.319 use weather maps to describe the movement of air masses, fronts, and storms and to predict their influence on local weather.

8.320 examine isobars on weather maps to describe how wind (moving air) travels from a region of high pressure to a region of low pressure.

8.321 examine maps of ocean currents and trace the origin and flow of such currents to explain the transfer of heat energy. Identify which currents have dominant influence on the Delaware coast.

8.322 compare and contrast weather and climate.

8.323 use diagrams or simulations of the hydrologic cycle to describe the Sun's effect on the water cycle and to describe the circulation of water through the Earth's crust, oceans, and atmosphere.

8.324 discuss the origin of the great storms of the east coast (e.g. hurricanes, "nor Easters", snow, and ice storms). Describe the environmental, economic, and human impact of these storms.

SCIENCE STANDARD FIVE

Earth's Dynamic Systems

END OF CLUSTER EXPECTATIONS

By the end of grade 8, students will know that:

Components of Earth

rocks and minerals are classified according to their chemical and physical properties. Rocks also are classified according to how they are formed.

sedimentary rocks, which are made of particles from other rocks and organic remains, are laid down in horizontal layers. Fossilized remains and successive layering of sedimentary rocks provide evidence of the Earth's history. Absolute age is determined by radioactive dating.

the atmosphere has properties that can be observed, measured, and used to predict changes in weather and to identify climatic patterns.

water falling to Earth flows over the surface as run-off and collects in ocean basins, rivers, lakes, ice capes, and underground. Water stored underground (sub-surface) and water stored above ground (surface) form a continuum, each supplying water to the other. Human activity and natural events can introduce chemicals affecting the quality of water supply.

Interactions Among Earth's Systems

volcanoes, earthquakes, and other mountain-building processes are responsible for most major features of the Earth's crust.

rocks are changed by erosion and deposition and by exposure to heat and pressure. There are a variety of physical and chemical processes that lead to the decomposition and breakdown of rocks and the eventual information of soils and sediments. These soils and sediments can then be transported to other places by wind, flowing water, waves, and ice.

the cycling of water in the atmosphere is driven by energy transfer processes, such as convection and radiation, and is constantly changing the location and phase of water.

uneven heating and cooling of Earth's surface produce various air masses which differ in density, humidity, and temperature. The origin, movement, and interaction of these air masses result in significant weather changes.

ocean currents affect the weather and long term climatic patterns of a region. Large bodies of water (oceans, the Great Lakes, inland seas) can also affect the weather and climate of an area.

Technology and Applications

instrumentation (e.g., pH meters, water analysis kits) and computer models enable the measure and analysis of environmental pollution. Sources of environmental pollution can be tracked using maps and satellite imagery.

The areas listed above will serve as the basis for Science assessment items in the Delaware Student Testing Program.

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PERFORMANCE INDICATORS
Earth's Dynamic Systems

Grade Six	Grade Seven	Grade Eight
		Topic: Explaining How the Sun's Energy Drives Earth's Weather and Climate (continued) **Students will be able to:** 8.325 examine satellite imagery pictures and describe the use of these images in photographing weather systems and producing forecasts. 8.326 identify factors that increase the acidity of rain water and explain the effects of acid rain on buildings, cars, plants, animals, lakes, etc.

SCIENCE STANDARD SIX

Life Processes

END OF CLUSTER EXPECTATIONS

By the end of grade 8, students will know that:

Structure/Function Relationship

the basic unit of all living organisms is the cell. In multicellular organisms, different cells are specialized to perform various tasks, and cells similar in shape and function are organized into groups (e.g., muscle cells, motor nerve cells).

cells contain a set of observable structures called organelles (e.g., cell wall, cell membrane, nucleus, chloroplast, and vacuole) that control the various functions of the cell, such as structural support, exchange of materials, photosynthesis, and storage of essential materials.

unicellular organisms perform, within a single cell, all of life's specific functions, such as water regulation, digestion, locomotion, and circulation, using specialized structures for each function.

Matter and Energy Transformations

plants make their food by the process of photosynthesis. Using light energy, green plants convert water and carbon dioxide into energy-rich simple sugars and oxygen. Sugar is the source of food used by most plants and ultimately, by all other consumers. Oxygen produced during photosynthesis is required for the survival of most plants and animals.

all living things obtain energy from food. Energy is needed for living cells to carry out all the processes of life, such as growing, disposing of wastes, making new cells, and using food.

Regulation and Behavior

all organisms obtain and use resources to grow, reproduce, and maintain a relatively stable internal environment while living in a constantly changing external environment. Regulation of an organism's internal environment involves sensing external changes in the environment and changing physiological activities to keep within the range required to survive. (National Science Foundation Standards, 1994)

behavior is one kind of response an organism makes to environmental stimuli. Behavioral responses require coordination and communication at many levels including cells, organ systems, and whole organisms.

Health and Technology Applications

the functioning and health of organisms, including humans, are influenced by heredity, diet, lifestyle, bacteria, viruses, parasites, and the environment. Certain body structures and systems function to protect against disease and injury.

sanitation measures such as the use of sewers, landfills, quarantines, and safe food handling are important in controlling the spread of organisms that cause disease.

The areas listed above will serve as the basis for Science assessment items in the Delaware Student Testing Program.

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PERFORMANCE INDICATORS
Life Processes

Grade Six

Topic: Investigating the Rock Cycle as Evidence of a Changing Earth

Students will be able to:

6.323 compare and contrast fossils and anatomical models to draw reasonable conclusions regarding evolutionary change over time (e.g., trilobites → horseshoe crabs, belemnites → squid).

Grade Seven

Topic: Investigating the Cellular Dimensions of Living Systems

Students will be able to:

7.311 identify and apply criteria for determining whether specimens or samples are living or nonliving.

7.312 observe both unicellular and multicellular organisms to identify common life processes. Recognize that the more complex the organism, the greater the extent of cellular specialization.

7.313 identify and describe how specific structures of living organisms are responsible for particular life processes.

7.314 compare and contrast the interactive systems of unicellular and multicellular organisms.

7.315 use microscopes and other appropriate tools and technology to observe and compare a variety of unicellular organisms. Explain how specific cellular structures perform such specialized functions as water regulation, digestion, locomotion, and circulation.

Grade Eight

Topic: Tracking Growth, Change and Adaptations in Ecosystems Over Time

Students will be able to:

8.339 construct food webs and identify the relationships among producers, consumers, and decomposers.

8.340 design food webs and trace the flow of matter and energy (beginning with the sun) through the food web. Recognize that energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis.

SCIENCE STANDARD SIX

Life Processes

END OF CLUSTER EXPECTATIONS

By the end of grade 8, students will know that:

Structure/Function Relationship
the basic unit of all living organisms is the cell. In multicellular organisms, different cells are specialized to perform various tasks, and cells similar in shape and function are organized into groups (e.g., muscle cells, motor nerve cells).

cells contain a set of observable structures called organelles (e.g., cell wall, cell membrane, nucleus, chloroplast, and vacuole) that control the various functions of the cell, such as structural support, exchange of materials, photosynthesis, and storage of essential materials.

unicellular organisms perform, within a single cell, all of life's specific functions, such as water regulation, digestion, locomotion, and circulation, using specialized structures for each function.

Matter and Energy Transformations
plants make their food by the process of photosynthesis. Using light energy, green plants convert water and carbon dioxide into energy-rich simple sugars and oxygen. Sugar is the source of food used by most plants and ultimately, by all other consumers. Oxygen produced during photosynthesis is required for the survival of most plants and animals.

all living things obtain energy from food. Energy is needed for living cells to carry out all the processes of life, such as growing, disposing of wastes, making new cells, and using food.

Regulation and Behavior
all organisms obtain and use resources to grow, reproduce, and maintain a relatively stable internal environment while living in a constantly changing external environment. Regulation of an organism's internal environment involves sensing external changes in the environment and changing physiological activities to keep within the range required to survive. (National Science Foundation Standards, 1994)

behavior is one kind of response an organism makes to environmental stimuli. Behavioral responses require coordination and communication at many levels including cells, organ systems, and whole organisms.

Health and Technology Applications
the functioning and health of organisms, including humans, are influenced by heredity, diet, lifestyle, bacteria, viruses, parasites, and the environment. Certain body structures and systems function to protect against disease and injury.

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PERFORMANCE INDICATORS

Life Processes

Grade Six	Grade Seven	Grade Eight
	Topic: Investigating the Cellular Dimensions of Living Systems (continued) **Students will be able to:** 7.316 use microscopes and other appropriate tools and technology to observe multicellular organisms (plant and animal cells) and explain how the structures of the major organelles are related to the functions they perform. 7.317 demonstrate an understanding of structure/function relationships at the cellular level using a variety of appropriate representations (e.g., analogy of a city or a factory performing a variety of specialized jobs, analogy of an automobile doing work, space stations at work, etc.). 7.318 recognize that for multicellular organisms, most interactions that sustain life take place at the cellular level. Explain how the energy and materials needed by cells to perform work and to build new materials are derived from the food and oxygen taken in by the organism. 7.319 select several human body systems and explain how they interact to transport the food and oxygen required by all cells to perform work and to build new materials.	

SCIENCE STANDARD SIX

Life Processes

END OF CLUSTER EXPECTATIONS

By the end of grade 8, students will know that:

Structure/Function Relationship

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PERFORMANCE INDICATORS
Life Processes

Grade Six	Grade Seven	Grade Eight
	Topic: Investigating the Cellular Dimensions of Living Systems (continued) **Students will be able to:** 7.320 conduct simple investigations (how the body reacts to exercise, changes in temperature, etc.) to determine how the systems in the human organism respond to various external stimuli to maintain stable internal conditions. 7.321 explain how the systems of the human body interact to protect against disease and injury. 7.322 research the sequence of events that lead to formulation of the cell theory and explain how the events correlate with technological advancements.	

SCIENCE STANDARD SEVEN

Diversity and Continuity of Living Things

END OF CLUSTER EXPECTATIONS

By the end of grade 8 students will know that:

Heredity

chromosomes, which are components of cells, occur in pairs and carry hereditary information. The subunits of chromosomes are genes which direct the formation of an organism's traits.

Reproduction and Development

in asexual reproduction, a new organism grows from a single cell or a cluster of cells provided by the parent and results in offspring genetically identical to the parent.

in sexual reproduction, gametes (egg and sperm), which are produced in specialized structures of the parents, fuse during fertilization to form an organism. Since each gamete contributes a set of chromosomes, the offspring have traits of both parents.

after the egg is fertilized, it undergoes an orderly series of changes involving cell division and differentiation as a new organism is formed. Each of the new cells in the developing organism receives an exact copy of the genetic information contained in the fertilized egg.

Evolution

natural selection is the process by which some individuals with certain traits are more likely to survive and produce greater numbers of offspring than other organisms of the same species. Conditions in the environment can affect which individuals survive in order to reproduce and pass their traits on to future generations. Small differences between parents and offspring accumulate over many generations and ultimately new species may arise.

anatomical comparisons and fossils provide evidence for evolution and indicate that the first organisms originated on the Earth between three and four billion years ago. The Earth's present-day species evolved from earlier, distinctly different species.

Diversity

organisms are currently classified into five kingdoms (monera, protista, fungi, plantal, animalia) based on similarities in structure and behavior.

a species is an important biological grouping of organisms whose members have similar structures, normally interbreed, and produce fertile offspring.

each structure in an organism is uniquely adapted to perform a particular function for enhancing the ability of the organism to survive. The great variety of body forms found in different species enables organisms to survive in diverse environments.

Health and Technology Applications

selective breeding is used to produce new varieties of cultivated plants and domesticated animals with enhanced traits.

knowledge gained from research in genetics is being applied to areas of human health.

The areas listed above will serve as the basis for Science assessment items in the Delaware Student Testing Program.

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PERFORMANCE INDICATORS
Diversity and Continuity of Living Things

Grade Six

Topic: Developing Criteria for Classifying Living and Nonliving Things

Students will be able to:

6.335 identify and apply criteria for determining whether specimens or samples are living or nonliving.

6.336 recognize that there is a standard system of classifying and naming species that is used throughout the world.

6.337 identify "kingdom" as the first main level of the standard classification system. Observe a variety of living organisms and determine into which kingdom they would be classified.

6.338 examine an assortment of plants and animals and use simple classification keys, based on observable features, to sort and group the organisms.

6.339 investigate appropriate methods that could be used to obtain samples of plants and animals from a specific area. Design and conduct a survey of the area to explain the diversity of local plants and animals.

6.340 discuss how the different species of plants and animals, from the area surveyed, might be classified. Develop classification flow charts (dichotomous keys) to group and classify the observed species.

Grade Seven

Topic: Genetics: The Key to Inheritance and Diversity

Students will be able to:

7.323 recognize that reproduction is a characteristic of all living systems and is essential to the continuation of the species.

7.324 compare and contrast asexual and sexual reproduction.

7.325 use models or diagrams to explain why sexually produced offspring are never identical to their parents.

7.326 use models or diagrams to identify the structures of a flowering plant that produce eggs and sperm and explain that plants also reproduce sexually.

7.327 distinguish between dominant and recessive traits.

7.328 use models to demonstrate that chromosomes and genes come in pairs and that chromosomes are composed of many genes. Use these same models to discuss how genetic material is transmitted from cell to cell or from parent to offspring.

Grade Eight

Topic: Tracking Growth, Change, and Adaptations in Ecosystems Over Time

Students will be able to:

8.337 survey the diversity of organisms in a local or model ecosystem and recognize that a population consists of all individuals of a species that occur together at a given place and time.

8.344 conduct a natural selection simulation to demonstrate how a specific trait has selective advantages for an organism.

8.345 investigate and discuss how short-term physiological adaptations of an organism (e.g., skin tanning, muscle development, formation of calluses) differ from long-term evolutionary adaptations (e.g., white coloration of polar bears, seed formation in plants) that occur in a group of organisms over generations.

SCIENCE STANDARD SEVEN

Diversity and Continuity of Living Things

END OF CLUSTER EXPECTATIONS

By the end of grade 8 students will know that:

Heredity

chromosomes, which are components of cells, occur in pairs and carry hereditary information. The subunits of chromosomes are genes which direct the formation of an organism's traits.

Reproduction and Development

in asexual reproduction, a new organism grows from a single cell or a cluster of cells provided by the parent and results in offspring genetically identical to the parent.

in sexual reproduction, gametes (egg and sperm), which are produced in specialized structures of the parents, fuse during fertilization to form an organism. Since each gamete contributes a set of chromosomes, the offspring have traits of both parents.

after the egg is fertilized, it undergoes an orderly series of changes involving cell division and differentiation as a new organism is formed. Each of the new cells in the developing organism receives an exact copy of the genetic information contained in the fertilized egg.

Evolution

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Health and Technology Applications

selective breeding is used to produce new varieties of cultivated plants and domesticated animals with enhanced traits.

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The areas listed above will serve as the basis for Science assessment items in the Delaware Student Testing Program.

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PERFORMANCE INDICATORS

Diversity and Continuity of Living Things

Grade Six	Grade Seven	Grade Eight
	Topic: Genetics: The Key to Inheritance and Diversity (continued)	
	Students will be able to:	
	7.329 construct Punnett squares and pedigree charts to demonstrate and predict how single gene traits such as seed shape in peas and tongue rolling in humans are transmitted to offspring.	
	7.330 use a variety of resources to develop a report on selective breeding. Select an organism (e.g., super sweet corn, oven stuffed roaster) and trace its history of development and the traits of the plant or animal that were enhanced by selective breeding.	
	7.331 select one area of biotechnology (genetic, reproduction, or embryonic research) and explain the human benefits as well as the economic, social, and ethical issues raised by such research.	
	7.332 recognize that species acquire many of their unique characteristics through biological adaptations, which involve the selection of naturally occurring variations in populations.	
	7.333 observe a variety of organisms and explain how a specific trait could increase an organism's chances of survival.	
	7.334 conduct a natural selection simulation to demonstrate that a specific trait has selective advantages for an organism.	

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SCIENCE STANDARD SEVEN

Diversity and Continuity of Living Things

END OF CLUSTER EXPECTATIONS

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PERFORMANCE INDICATORS

Diversity and Continuity of Living Things

Grade Six	Grade Seven	Grade Eight
	Topic: Genetics: The Key to Inheritance and Diversity (continued) **Students will be able to:** 7.3S5 Explain how the extinction of a species occurs when the environment changes and the adaptation of a species is insufficient to allow for its survival.	

SCIENCE STANDARD EIGHT

Ecology

END OF CLUSTER EXPECTATIONS

By the end of grade 8, students will know that:

Flow of Matter and Energy in an Ecosystem

an ecosystem consists of all the organisms that live together and interact with each other and their physical environment.

interactions in an ecosystem result from the transfer of matter and energy from producers to consumers and eventually to decomposers. The total amount of matter and energy in the system remains the same even though its from and location changes.

matter is recycled in an ecosystem, and energy which enters the system as sunlight is stored in the bodies of organisms, used by consumers to support their activities, or dissipated to the environment as heat energy. Loss of heat from an ecosystem is compensated for by continuous input of solar energy.

Change in Ecosystems

changes in the physical or biological conditions of an ecosystem can alter the diversity of species in the system. As the ecosystem changes, populations of organisms must adapt to these changes, move to another ecosystem, or become extinct.

the size of populations in an ecosystem may increase or decrease as a result of the interrelationships among organisms, availability of resources, natural disasters, habitat changes, and pollution.

Technology and Its Influence on the Environment

agriculture relies heavily on technology to increase productivity. Advances in irrigation allow crops and to control damage done by rodents, fungi, insects, and weeds. The need to increase agricultural production results in environmental trade-off (e.g., saltwater intrusion, water table lowering, agricultural runoff into rivers/streams, elimination of beneficial insects, desertification).

Interaction of Humans Within Ecosystems

the extinction or introduction of species can affect the stability of ecosystems. With careful planning, humans may be able to sustain ecosystems for their use as well as preserve their biodiversity and natural beauty.

decisions about the use of natural resources are often determined by a society's short-term needs for the resources with little regard for long-term consequences. The supply of natural resources such as water and petroleum is finite. Nonmaterial resources (e.g., tranquillity, beautiful scenery) cannot be easily quantified but must be preserved.

The areas listed above will serve as the basis for Science assessment items in the Delaware Student Testing Program.

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PERFORMANCE INDICATORS
Ecology

Grade Six	Grade Seven	Grade Eight
	Topic: Genetics: The Key to Inheritance and Diversity **Students will be able to:** 7.332 recognize that species acquire many of their unique characteristics through biological adaptations, which involve the selection of naturally occurring variations in populations. 7.333 observe a variety of organisms and explain how a specific trait could increase an organism's chances of survival. 7.334 conduct a natural selection simulation to demonstrate that a specific trait has selective advantages for an organism. 7.335 explain how the extinction of a species occurs when the environment changes and the adaptation of a species is insufficient to allow for its survival. **Topic: Understanding the Importance of Protecting Delaware Watersheds** 7.336 use maps to locate Delaware watersheds and to identify the bodies of water into which they drain. 7.337 use models or diagrams to explain how water stored underground and water stored above ground form a continuum, each supplying water to the other. 7.338 use diagrams of the hydrologic cycle to describe the circulation of water through the Earth's crust, oceans, and atmosphere.	**Topic: Tracking Growth, Change and Adaptations in Ecosystems Over Time** **Students will be able to:** 8.337 survey the diversity of organisms in a local or model ecosystem and recognize that a population consists of all individuals of a species that occur together at a given place and time. 8.338 categorize populations of organisms according to the functions they serve in an ecosystem. 8.339 construct food webs and identify the relationships among producers, consumers, and decomposers. 8.340 design food webs and trace the flow of matter and energy (beginning with the Sun) through the food web. Recognize that energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis. 8.341 describe factors (e.g., space, food, water, disease) that limit the number of organisms an ecosystem can support. 8.342 construct data tables or line graphs to show population changes of a selected species over time.

SCIENCE STANDARD EIGHT

Ecology

END OF CLUSTER EXPECTATIONS

By the end of grade 8, students will know that:

Flow of Matter and Energy in an Ecosystem

an ecosystem consists of all the organisms that live together and interact with each other and their physical environment.

interactions in an ecosystem result from the transfer of matter and energy from producers to consumers and eventually to decomposers. The total amount of matter and energy in the system remains the same even though its from and location changes.

matter is recycled in an ecosystem, and energy which enters the system as sunlight is stored in the bodies of organisms, used by consumers to support their activities, or dissipated to the environment as heat energy. Loss of heat from an ecosystem is compensated for by continuous input of solar energy.

Change in Ecosystems

changes in the physical or biological conditions of an ecosystem can alter the diversity of species in the system. As the ecosystem changes, populations of organisms must adapt to these changes, move to another ecosystem, or become extinct.

the size of populations in an ecosystem may increase or decrease as a result of the interrelationships among organisms, availability of resources, natural disasters, habitat changes, and pollution.

Technology and Its Influence on the Environment

agriculture relies heavily on technology to increase productivity. Advances in irrigation allow crops and to control damage done by rodents, fungi, insects, and weeds. The need to increase agricultural production results in environmental trade-off (e.g., saltwater intrusion, water table lowering, agricultural runoff into rivers/streams, elimination of beneficial insects, desertification).

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PERFORMANCE INDICATORS
Ecology

Grade Six

Grade Seven

Topic: Understanding the Importance of Protecting Delaware Watersheds (continued)

Students will be able to:

7.339 recognize that water is a solvent and as it passes through the water cycle it dissolves minerals, gases, and pollutants and carries them to surface water and ground water supplies.

7.340 identify the sources of drinking water for the citizens of Delaware.

7.341 conduct tests (e.g., pH, dissolved oxygen) or surveys (e.g., macroinvertebarte) to determine the ecological health and potability of local water samples.

7.342 conduct investigations to determine the extent to which the permeability and porosity of a soil sample effect water percolation.

7.343 describe the role of wetlands and streamside forests (riparian) in filtering water as it runs off into local streams, rivers, and bays or seeps into ground water.

7.344 distinguish between point source water pollutants and non-point source water pollutants.

7.345 explain the impact of human activities (e.g., farming, building roads, fertilizing golf courses, etc.) on the quality of Delaware's waters.

Grade Eight

Topic: Tracking Growth, Change, and Adaptations in Ecosystems Over Time

Students will be able to:

8.343 observe graphs or data tables showing both the population growth of a species and the consequences of resource depletion on the population. Analyze the data and explain how exponential growth can have a dramatic effect on resources.

8.344 conduct a natural selection simulation to demonstrate how a specific trait has selective advantages for an organism.

8.345 investigate and discuss how short-term physiological adaptations of an organism (e.g., skin tanning, muscle development, formation of calluses) differ from long-term evolutionary adaptations (e.g., white coloration of polar bears, seed formation in plants) that occur in a group of organisms over generations.

8.346 investigate local areas, disturbed and undisturbed, that are undergoing natural cycles of succession, such as abandoned gardens; uncut areas beneath power lines; areas along ditch banks, fences, and the edge of a forest. Predict how plant communities that grow in the area may change over time and how their presence determines what kinds of animals may move into and out of the areas.

SCIENCE STANDARD EIGHT

Ecology

END OF CLUSTER EXPECTATIONS

By the end of grade 8, students will know that:

Flow of Matter and Energy in an Ecosystem

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PERFORMANCE INDICATORS

Ecology

Grade Six

Grade Seven

Topic: Understanding the Importance of Protecting Delaware Watersheds (continued)

Students will be able to:

7.3**4**6 research the processes used by municipalities to ensure water taken from local reservoirs is safe to drink.

7.3**4**7 investigate the extent to which legislation such as the Clean Water Act has impacted the quality of Delaware water.

7.3**4**8 explain how sanitation measures such as sewers, landfills, and water treatment are important in controlling the spread of organisms that contaminate water and cause disease.

Grade Eight

Topic: Tracking Growth, Change, and Adaptations in Ecosystems Over Time (continiued)

Students will be able to:

8.3**4**7 research and analyze data on human population changes that have occurred in a specific Delaware area or county. Discuss reasons for changes in human population and explain how these changes have affected biodiversity and availability of natural resources (e.g., habitat loss, water quality, preservation/concentration efforts).

8.3**4**8 investigate some of the economic and environmental tradeoffs given Delaware's short-term and long-term resource management plans.

8.3**4**9 contact the Department of Natural Resources or a wildlife agency to acquire information on animals or plants that have been introduced to Delaware. Investigate issues that relate to the introduction or reintroduction of a species into a local habitat (e.g., Norway Maple, Delmarva Fox Squirrel, Gypsy Moth, Phragmites)

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